INFORMATION ON DUST EXPLOSIONS FOR THE FIRE SERVICE

(Explanatory material to accompany "true or false" dust explosion statements)

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It is generally known that the dust explosion hazard exists in more than 28,000 industrial plants in the United States. (#1).

By "dust explosion" is meant a rapid burning of a cloud of combustible dust in suspension in air. In order to have a dust explosion two things are necessary: (1) a cloud of combustible dust in suspension in air in proper proportions; (2) a source of ignition. There is no such thing as a spontaneous dust explosion. The combustible dust and air mixture must be ignited. (#17, #19, #24).

When flame propagates through a dust cloud or, in other words, when a dust explosion occurs, the air and the products of combustion are expanded due to the heat evolved, and this expansion creates pressure which forces out surrounding windows, walls, ceilings, etc. (#10).

Dust explosions have occurred in many industries associated with the processing of agricultural products such as sugar refining, the preparation of cocoa, starch, malt, powdered milk and other food products, wood pulp, wood products, cork, soap powder, paper products and many others. Explosions have also occurred in industries manufacturing and using powdered metals such as aluminum and magnesium. (#2).

Since a dust explosion can be propagated only through a material which is combustible, such dusts as shale, silica, limestone, slate, clay, cement, street dusts and other inert dusts are not explosive. (#3, #21).

Woodworking plants produce large quantities of wood dusts, the finer portions of which form explosive mixtures when suspended in air in the proper proportions. Firemen are, therefore, exposed to the dust explosion hazard when fighting fires in plants of this character. (#4).

When fighting fires in enclosed places where there is an accumulation of settled or static combustible dust, it is dangerous to use full streams of water at high pressure. Such streams may strip up clouds of dust and these may become ignited and explode with resultant injury or death to firemen working nearby. (#5).

In places where large quantities of combustible dust are present, falling floors or the collapse of bottoms of storage bins frequently throw large clouds of dust into suspension. This creates a dangerous dust explosion hazard if there is a fire in progress at a lower level regardless of the fact that firemen may be applying large quantities of water to this fire. If firemen know or suspect that there is a fire inside bins or enclosures housing combustible dusts, no attempt should be made to remove the materials until they have been thoroughly wet

down. A spray nozzle should be used for this purpose rather than a heavy hose stream. (#6, #7).

Powdered aluminum should never be wet down in order to cool it, whether it is burning or only hot from proximity to an adjacent fire. Even at low temperatures, aluminum powder will combine with the oxygen from water and when this occurs the hydrogen from the water will be released. The hydrogen, being highly inflammable, will burn violently if it becomes ignited by a fire in progress. In addition, the force of a stream of water directed into an accumulation of aluminum powder would probably throw a cloud of the dust into suspension in the air and a violent explosion might result if a source of ignition were present. (#8, #20, #23).

Dust explosions can and do occur in buildings other than those used for manufacturing purposes. Grain elevators and warehouses are good examples of buildings in which dust explosions occur, but in which no manufacturing is carried on. (#12).

Humidity, or the amount of moisture in the atmosphere apparently has little effect on the possibility of the occurrence of a dust explosion. If the dust will burn readily and is of such a nature that moisture will not make the particles stick together in such large masses that the dust will not float in air, a dust explosion will propagate through a cloud of the dust. In other words, a dust explosion can occur on a rainy day as well as on a dry day. (#9).

Experience has shown that it is not practical to attempt to construct buildings with sufficient structural strength to withstand dust explosions. Rather, it has been found advisable to provide large vent areas in order to allow the escape of pressure during the course of a dust explosion and thus to reduce the amount of structural damage. One of the simplest ways to do this is to provide large window areas. Tests have shown that if window panes are scored diagonally on the outside surface, the resistance to pressure on the inside surface is greatly reduced. This will cause the glass to break at a low pressure and thus make it possible to vent the force of a dust explosion with little or no damage to the building itself. (#11, #16).

Ordinary drop cord electric lights, torches, lanterns or other open flames should never be used as a source of light when examining rooms or bins containing grain, sawdust or other dusty products. Flash lights or extension cords and electric lights of the type approved for use in dusty locations should always be used. (#18, #25).

If an electric lamp breaks while it is lighted the vacuum inside the glove will draw air into the space surrounding the filament. The filament will remain hot momentarily, and if the air drawn in is heavily laden with dust, the hot filament will act as a source of ignition and a small primary dust explosion may occur. The primary explosion would probably set fire to the large dust cloud surrounding the lamp and a large secondary explosion would occur. (#22).

Static electricity, a potential source of ignition, is frequently generated on transmission belts, conveyor belts and the ducts of air conveying systems. It is important, therefore, that all such belts and ducts should be electrically grounded, in order that static charges may be properly removed. (#14).

Two of the most important items which tend to reduce the possibility of dust explosions are cleanliness and good housekeeping. If there are no accumulations of dust on floors, beams, ledges, etc., a primary dust explosion will probably expend its energy with a comparatively small amount of disturbance and no secondary explosion will follow. Under these conditions the damage to property will probably be small and the loss will be minimized. (#13).

The introduction of a sufficient quantity of an inert gas such as carbon dioxide or nitrogen into enclosed grinding and conveying equipment will prevent or retard the propagation of a dust explosion in such enclosure. Sufficient gas must be introduced to reduce the amount of oxygen in the resultant atmosphere to a point where it is insufficient to support combustion of the type of dust present in the enclosure. (#15).

DUST EXPLOSION STATEMENTS

INSTRUCTIONS

Read carefully each of the statements which follow. Decide whether it is true or false. If the statement is correct or true, circle the "T"; if it is incorrect or false, circle the "F".

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1. T. F. The dust explosion hazard exists in only a few industrial plants in the United States.

2. T. F. Powdered milk, cocoa, soap and wood dusts are not likely to create dust explosion hazards.

3. T. F. Street dust, rock dust, limestone dust and cement dust, when mixed with air, are highly explosive.

4. T. F. Firemen are seldom exposed to the hazard of dust explosions while fighting fires in woodworking plants.

5. T. F. A full stream of water at high pressure should never be used for fighting fire in enclosed places where there is an accumulation of settled or static dust.

6. T. F. Dust or powdered products in bins or other enclosures should not be removed during the course of a fire in or near the bins or enclosures unless the material has been thoroughly wet down by means of a spray nozzle.

7. T. F. The falling of floors or the dropping of the bottom of storage bins where dust is present is not particularly dangerous from a dust explosion standpoint if firemen are directing one or more good streams of water on to the fire below.

8. T. F. In order to cool down a fire in or near powdered metals such as aluminum, water should be directed on to the hot metal.

9. T. F. A dust explosion cannot occur when the relative humidity or moisture content of the air is very high.

10. T. F. The destruction resulting from a dust explosion is caused by the expansion of the air and the products of combustion resulting from the burning of a dust cloud.

11. T. F. It is practical to prevent the destruction of a building by a dust explosion by designing the building to withstand heavy pressures.

12. T. F. A dust explosion can occur in a building where no manufacturing is done.

13. T. F. Cleanliness and good housekeeping are big factors in reducing the dust explosion hazard and minimizing losses.

14. T. F. Power transmission belts, conveyor belts and ducts of air conveying systems should not be electrically grounded.

15. T. F. Sufficient reduction of the oxygen content of the air in and enclosed grinding or conveying system by means of the introduction of an inert gas such as carbon dioxide will in most cases retard or prevent a dust explosion.

16. T. F. Diagonal scoring on the outside surface of window glass will reduce the pressure at which the glass will be blown out by an explosion and the vent thus created will reduce structural damage to buildings.

17. T. F. In order to produce a dust explosion it is not necessary for a source of ignition to be present.

18. T. F. An ordinary drop cord electric light is the safest appliance for use in examining bins in which grain, sawdust and other dusty products are being stored.

19. T. F. A dust explosion is a very rapid burning of a combustible dust in suspension in air.

20. T. F. If water is thrown onto burning aluminum or magnesium powder, hydrogen from the water will be released and will burn and oxygen from the water will intensify the fire by combining chemically with the aluminum or magnesium.

21. T. F. If dust shaken from a cheesecloth bag burns when it comes in contact with an open flame, it is an indication that the same kind of dust may explode when mixed with air in proper proportions and ignited.

22. T. F. The breaking of a lighted electric lamp globe in a dusty atmosphere can cause an explosion.

23. T. F. Aluminum dust is much more explosive than shale dust.

24. T. F. There is no such thing as a spontaneous dust explosion.

25. T. F. Oil lanterns or torches may be used without danger when inspecting dusty rooms.